# CITY OF SAN ANTONIO

P.O. BOX 839966
SAN ANTONIO, TEXAS 78283-3966
Traffic Engineering Division
Public Works Department

March 3, 2004

To Whom It May Concern:

Re: Item #531 – SIGNS, City of San Antonio Standard Specifications for Public Works Construction

Attached is the revised specification for ITEM 531 – SIGNS dated January 2003 that is intended to replace any previous dated verison of this specification of the City's Standard Specifications for Public Works Construction and is effective the date of this notice.

This specification revises the requirements for the types of retroreflective materials to be used in the manufacture of street and highway signs to be used on any City of San Antonio project. Basically, all signs shall be of "High Intensity" material except signs to be used in overhead installations that shall be of "Diamond Grade" material. The use of "Engineer Grade" material is no longer allowed.

Any questions concerning the revised specification should be directed to either the Traffic Engineer or the Traffic Operations Manager of the Public Works Department for the City of San Antonio.

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Traffic Engineer

cc: Kent Hickingbottom, Traffic Operations Manager
Razi Hosseini, P.E., Assistant City Engineer

# ITEM 531
# SIGNS

*This specification applies to the furnishing of retroreflective and non-retroreflective signs constructed of aluminum substrate to the dimensions specified and the installation of signs of varying sizes and legends as shown on the plans or as specified by the Engineer.*

## MATERIALS:

The following ASTM Standards and documents, of the issue in effect on the date of Invitation for Bid, form a part of this specification to the extent herein.

1) B 209 Specification for Aluminum and Aluminum Alloy Sheet and Plate

2) D 523 Standard Method for Test for Specular Gloss

3) D 4956 Standard Specification for Retroreflective Sheeting for Traffic Control

4) E 284 Standard Definition of Terms Relating to Appearance of Materials

5) E 308 Computing the Colors of Objects by Using the CIE System

6) E 810 Standard Test Method for Coefficient of Retroreflection of Retroreflective Sheeting

7) E 1164 Standard Practice for Obtaining Spectrophotometric Data for Object-Color Evaluation

8) CIE Publication Number 39-2, Recommendation for Surface Colors for Visual Signaling

9) FP-92 Standard Specifications for Construction of Roads and Bridges on Federal Highway Project

## SUBSTRATE:

This shall be aluminum alloy 5052-H38 and otherwise in conformance with ASTM B-209 and have gold chromate finish. The size, shape and thickness of the sign blanks are as indicated on the standard detail sheet in the plans or as specified by the Engineer.

(A) Metal working: The aluminum shall be free of burrs and pits on both sides, including edges and holes, and shall be made ready for applications of the sheeting.

(B) Surface Preparation: The aluminum shall be thoroughly cleaned and degreased with solvent and alkaline emulsions cleaner by immersion, spray, or vapor degreasing and dried prior to application of the gold chromate sheeting coat. The aluminum shall be new and corrosion-free with holes drilled or punched, corners rounded to the radii shown in the standard detail sheet, and all edges smoothed prior to application of sheeting. The heavy or medium chromate coating shall conform in color and corrosion resistance to that imparted by the Alodine 1200F treatment.

(C) Size: The dimensions of substrate applications for regulatory, warning, and guide signs be as specified by the Engineer and as shown on the plans.

## BACKGROUND, LEGENDS, SYMBOLS AND COLORS:

These shall be in accordance with the Standard Highway Sign Designs (SHSD) for Texas and with the Texas Manual of Uniform Traffic Control Devices (TMUTCD).

(A) Retroreflective Materials: Retroreflective materials shall comply with "Standard Specifications for construction of Roads and Bridges on Federal Highway Projects", FP-85 and Federal Specifications L-S-300C. The Contractor shall furnish a certification that the materials comply with the requirements of FP-85 and L-S-300C.

2) Retroreflective Sheeting - Type III (High Intensity): The materials as listed in these specifications shall comply with FP-85, Section 718 and L-S-300C. Colors shall be as specified in specifications for Standard Highway Sign Colors (FHWA, HTO-21).

3) Retroreflective Sheeting - Type IX (Diamond Grade Fluorescent yellow green, VIP Reflective Sheeting): The materials shall comply with ASTM 4956. Designed to provide higher nighttime sign brightness in the legibility distance and brightness at high entrance angles. The minimum fluorescence luminance factor ($Y_F$) for new sheeting shall be 35%.

(B) Electronically Cuttable Film: Electronically cuttable film shall consist of flexible, transparent, durable acrylic colored films coated with a transparent pressure sensitive adhesive protected by a clear removable liner. These films are designed to be applied to retroreflective materials for the creation of traffic control signs and devices by either cutting by knife over roll (sprocket fed or friction fed) and flat bed electronic cutting machines. The films shall be available in standard traffic colors, be dimensionally stable, and be designed to optimally cut, weed, lift, and transfer. Use of electronic cuttable films will not require the release of any volatile organic compounds.

When electronic cuttable film is applied to retroreflective sheeting, the resulting color of the composite sheeting will conform to Federal Specification FP-92, Section 718.01 and ASTM D 4956 or to the using agency specification for the appropriate retroreflective sheeting to which it is applied.

Only signage utilizing electronically cuttable film will be allowed. Silk screened sign faces will not be accepted.

1) Color Test: Conformance to color requirements shall be determined by instrumental method in accordance with ASTM E 1164 on sheeting applied to aluminum test panels. The values shall be determined on a HunterLab Labscan 6000 0/45 Spectrocolorimeter with option CMR 559 [or approved equal 0/45 (45/0) instrument with circumferential viewing (illumination)]. Computations shall be done in accordance with ASTM E 308 for the 2° observer.

2) Coefficient of Retroreflection R^. When electronic cuttable film is applied to retroreflective sheeting, the composite will conform to the percentage retained of the minimum coefficient of retroreflection specified by the using agency and the manufacturer for the retroreflective sheeting when the retroreflective sheeting is screen processed. The coefficient of retroreflection shall be determined in accordance with ASTM E 810. Coefficients of retroreflection R^ shall be specified in units of candelas as per foot candle per square foot (candelas per lux per square meter). The observation angles shall be 0.2 and 0.5 degrees unless otherwise specified. The entrance angles shall be –4 and 30 degrees unless otherwise specified. The electronic cuttable film shall have and 85° specular gloss of not less than 50 when tested in accordance with ASTM D 523.

3) Processing and Cuttability: The electronic cuttable film shall permit cutting, weeding, masking with transfer tape, lifting, and application to retroreflective sheeting when used in accordance with manufacturer's recommendations at temperatures between 65° and 95° F (18.3° and 35.0°

C) and relative humidifies between 30% and 70%. The film shall lay flat with minimal edge curl and be dimensionally stable.

4) Adhesive Liner: The protective liner attached to the adhesive shall be removable by peeling without soaking in water or other solutions, without breaking, tearing, or removing any adhesive from the electronic cuttable film. The liner shall have a controlled release from the adhesive coated film sufficient to allow cutting without the film popping off from the liner while still allowing the liner to easily be peeled from the film.

5) Film with punched edges for use on sprocket fed knife over roll cutters shall be edge scored and weeded to remove film in the punched area as a means of eliminating adhesive build up on the sprockets.

6) Resistance to Accelerated Outdoor Weathering: When electronic cuttable film is applied to retroreflective sheeting, the surface of the film shall be weather resistant and show no appreciable cracking, blistering, crazing, or dimensional change after 2 years unprotected outdoor exposure, facing the equator and inclined 45° from the vertical. Following weather exposure, panels shall be washed in a 5% HCI solution for 45 seconds, rinsed thoroughly with clean water, blotted dry with a soft cloth and brought to equilibrium at standard conditions. After cleaning, the coefficient of retroreflection shall not be less than the value specified by the using agency for the retroreflective sheeting when the retroreflective sheeting is screen processed. Show no appreciable evidence of cracking, scaling, pitting, blistering, edge lifting or curling or more than 1/32 inch (0.08 cm) shrinkage or expansion. Show good color fastness or better when tested. The electronic cuttable film shall not be removable from the retroreflective sheeting without damage.

7) The sign face, made of electronic film and retroreflective sheeting shall comply with the appearance, specification, and good workmanship designated by the using agency for sign faces constructed of screen processed retroreflective sheeting of the same type.

(C) Non-Retroreflective Sheeting: All letters, numerals, and symbols shall be as prescribed in this specification.

(D) Application Methods: The method of application of sheeting, letters, numbers, and symbols shall be precisely as prescribed in writing by the manufacturer.

1) Legend spacing and Layout -- Spacing and layout for all traffic control signs shall conform to the SHSD.

a) Tolerance for Horizontal Alignment: Letters, numerals, and symbols shall be horizontally aligned to a tolerance of 1/16 inch [1.5 mm]. Test of each sign board shall be as follows:

b) Place a metal straight edge along the bottom of a series of letters forming each line of the sign. In each line, letters shall not vary more than 1/16 inch [1.5 mm] from that line.

c) Tolerance for Vertical Alignment: Letters, numerals, and symbols shall be vertically aligned to a tolerance of 1/16 on each letter in each line:

d) Place a metal straight edge along the bottom edge of a series of letters forming each line of the sign. Place a square

along the straight edge and test the trueness of the vertical faces of individual letters. Letters shall be normal to the square within 1/16 inch [1.5 mm].

**SIGN POSTS:**
Steel post shall conform to the standard specification for hot rolled carbon sheet steel, structural quality, ASTM designation A570, Grade 50. Average minimum yield strength after cold forming is 60,000 psi. The cross section of the post shall be square tube formed steel, carefully rolled to size and shall be welded directly in the corner by high frequency resistance welding or equivalent process and externally scarified to agree with corner radii. Sign posts shall be hot dipped galvanized conforming to ASTM A653, G90.

Perforated sign posts, anchors and sleeves shall be of the following size:

| Size | USS Gauge | Weight |
|---|---|---|
| 1 ½" X 1 ½ " | 14 | 1.71 |
| 1 3/4" X 1 3/4" | 14 | 1.71 |
| 2" X 2" | 12 | 2.42 |
| 2 ¼" X 2 ¼" | 12 | 2.77 |

Holes shall be 7/16 ± 1/64 inches in diameter on one inch centers on all four sides down the entire length of the post. On square tubing, holes shall be on centerline of each side in true alignment and opposite each other directly and diagonally. The length of each post shall have a permissible length tolerance of ± ¼".

The finished posts shall be straight and have a smooth, uniform finish. It shall be possible to telescope all consecutive sizes of square tubes freely and for not less than ten feet of their length without the necessity of matching any particular face to any other face. All holes and ends shall be free from burrs and ends shall be cut square.

**Tolerance on outside sizes:**

| Nominal Outside Dimension | Outside Tolerances at Corners |
|---|---|
| 1 ½" X 1 ½" | ±.006" |
| 1 ¾" X 1 ¾" | ±.008" |
| 2" x 2" | ±.008" |
| 2 ¼" X 2 ¼" | ±.010" |

Note: Measurement from outside dimensions shall be made at least 2 inches from the end of the tube.

Permissible variation in wall thickness is + .011", - .005"

Convexity and concavity shall be measured in the center of the flat sides, tolerance in ± .010", determined at the corner.

**Squareness of Sides and Twist Permissible in 3" Length:**

| Nominal Outside Dimensions | Squareness Tolerance | Twist |
|---|---|---|
| 1 ½" x 1 ½" | ±.009" | .050" |
| 1 ¾" x 1 ¾" | ±.010" | .062" |
| 2" X 2" | ±.012" | .062" |
| 2 ¼" X 2 ¼" | ±.014" | .062" |

Permissible variation in straightness is 1/16 of an inch in 3 feet. The standard outside corner radius shall be 5/32 of an inch ± 1/64 inch.

1) Installation: The square end of the post shall not be modified or pointed.

    a) Flange: When sign post installation is required over building basements, bridges and cavities, a galvanized cast iron pipe flange shall be used. The base shall be 8 inches [203 mm] in diameter with six 5/16 inch [7.5 mm] holes drilled equidistant around the circumference, 5/8 inch [15 mm] from the outer edge. The neck of the flange shall be 3

inches [76 mm] in diameter, drilled and threaded to receive a 2 inch [50 mm] diameter galvanized post.

b) Hardware: All ground mounted signs shall be attached to posts using 3/8" aluminum colored drive rivets. Stainless steel banding material, brackets and clips will be used for signs installed on light standards or mast arms.

c) Construction: Anchors shall be anchored in a minimum of one cubic foot [0.03 cubic meters] of class "C" concrete, 22 inches [457 mm] deep, with a 6 inch [152 mm] long, 3/8 inch [9 mm] diameter pin inserted through the pre-drilled hole 3 inches [76 mm] from the bottom of the pole. Where the pole installation requires surface mounting, an 8 inch [203 mm] flange with a 2 inch [50 mm] threaded collar shall be used. The pole shall be galvanized, two inches [50 mm] in diameter and threaded to fit the flange. Sign placement and orientation shall be as specified in the construction plans.

**ANTI-VANDALISM AND MAKER'S MARK DECALS:**

The antivandalism decal shall be installed on the back bottom left corner of the sign. Decals will be supplied by the Traffic Operations Section (207-7765). Each sign shall be permanently marked on the lower right corner of the back side with the month and year of installation, and name of manufacturer.

## WARRANTY:

The Contractor shall warrant the materials and workmanship of each sign in accordance with the maximum limits of material warranties extended by manufacturers of raw materials, subject to the conditions they specify. Type III and Type IX, Fluorescent Yellow Green, sheeting processed and applied to sign blank materials in accordance with sheeting manufacturer's recommendations, shall perform effectively for the number of years stated in Tables I & II of this specification. The retroreflective sheeting will be considered unsatisfactory if it has deteriorated due to natural causes to the extent that: (1) the sign is ineffective for its intended purpose when viewed from a moving vehicle under normal day and night driving conditions; or (2) the coefficient of retroreflection is less than the minimum specified for that sheeting during that period listed in Tables I and II. When sign failure occurs prior to the minimum years indicated and an inspection demonstrates that the failure is caused by materials warranted to contractor to endure at least that long, the sign will be replaced or repaired free of materials charges. When failure occurs and inspection demonstrates that such failure is due to poor workmanship, the sign will be replaced or repaired at Contractor's expense, including shipping charges.

TABLE I
Minimum Coefficient of Retroreflection
Candelas per Foot -Candle per sq. Ft.
(.2° observation angle and -4° entrance angle)

| | |
|---|---|
| Type III Sheeting: | |
| Life Span | 10 |
| years | |
| Sheeting Color: | |
| White | 200 |
| Yellow | 136 |
| Green | 36 |
| Red | 36 |
| Blue | 16 |
| Brown | 9 |

TABLE II
Minimum Coefficient of Retroreflection
Candelas per lux per square meter ($cd/lux/m^2$)
(.2° observation angle and -4° entrance angle)

| | |
|---|---|
| Type IX Sheeting: | |
| Life Span | 7 |
| | |
| Fluorescent Yellow Green | 325 |

## CONSTRUCTION METHODS:

If a signalized intersection has either mast arms or span-wire on which overhead street name signs can be attached, no ground mounted streets name signs are required at that intersection. Street name signs shall always be supplied and installed at each project intersection whether signs previously existed at the location or not. Overhead street name signs installed outside of the Central Business District shall be 15 inches high with 6 ½ inch letters and 4 ½ inch block numbers. Overhead street name signs installed inside the Central Business District shall be 18 inches high with 8 inch letters and 4 ½ inch block numbers. Overhead street name signs shall be installed on all approaches. Signs shall be bolted or strapped to the mast arm or span wire. Attachments to mast arms shall be by means of a 5/8 inch stainless steel strap and a stainless steel flared strap bracket. At unsignalized intersections, ground-mounted street name signs of 9 inch heights with 4 inch letters and 2 inch block numbers are required.

Construction shall be high quality with no visible defects in the finished product. Fabrication shall be in accordance with these specifications.

### EXISTING SIGNS:

The removal of existing signs shall be coordinated with the Traffic Division to assure required signage is in place during all construction phases. When existing signs are to be removed, they will be unbolted from their post by hand and delivered to the Traffic Operations Section (207-7765).

## MEASUREMENT AND PAYMENT:

Measurement shall be based on the number of satisfactorily installed signs.

The accepted quantities shall be paid at the contract unit price for the sign type applicable in the bid list which shall be full compensation, furnishing of all materials, labor, tools, equipment, and supplies to construct signs of varying sizes and legends as shown on the plans or as specified by the Traffic Design Engineer.

## BID ITEMS:

Item 531.01: 15 inch [381 mm] Metro Street Name, Block Numbers*

Item 531.02: 18 inch [457 mm] Metro Street Name, Block Numbers*

Item 531.03: R1-1 STOP*

Item 531.04: R1-2 YIELD*

Item 531.05: R1-4 ALL WAY plate*

Item 531.06: R2-1 Speed Limit*

Item 531.07: R3-1 No Right Turn*

Item 531.08: R3-2 No Left Turn*

Item 531.09: R3-3 NO TURNS*

Item 531.10: R3-4 No U-Turns*

Item 531.11: R3-5 Left or Right Only*

Item 531.12: R3-6 Lane-Use Control*

Item 531.13: R3-7 LEFT LANE MUST TURN LEFT or RIGHT LANE MUST TURN RIGHT*

Item 531.14: R3-8 Lane-Use Control*

Item 531.15: R3-8 U-Turn Only*

Item 531.16: R3-9 Two Way Left Turn Only*

Item 531.17: R4-7 Keep Right*

Item 531.18: R5-1 DO NOT ENTER*

Item 531.19: R6-1 ONE WAY*

Item 531.20: R6-2 ONE WAY*

Item 531.21: R7-1 NO PARKING ANYTIME*

Item 531.22: R7-18 NO PARKING THIS SIDE THIS BLOCK*

Item 531.23: *No sign assigned to this item*

Item 531.24: R9-3a Pedestrian Crossing Prohibited*

Item 531.25: R10-11 NO TURN ON RED 7-9 AM AND 2-4 PM, SCHOOL DAYS ONLY*

Item 531.26: R10-11a NO TURN ON RIGHT*

Item 531.27: R10-12 LEFT TURN YIELD ON "Green Ball"*

Item 531.28: R10-5 LEFT ON ARROW ONLY*

Item 531.29: R10-6 STOP HERE ON RED*

Item 531.30: R10-7 DO NOT BLOCK INTERSECTION*

Item 531.31: S-25 NO PARKING 7-9 AM AND2-4 PM SCHOOL DAYS ONLY*

Item 531.32: S-26 NO PARKING 7-9 AM AND2-4 PM STUDENT LOADING, SCHOOL DAYS ONLY*

Item 531.33: S-27 NO PARKING 7-9 AM AND 2-4 PM SCHOOL BUS ZONE*

Item 531.34: S1-1 Advance School Crossing and School Crossing**

Item 531.35: W16-7 Diagonal Arrow sign**

Item 531.36: S4-1 1\20 MPH School Sign***

Item 531.37: W1-1 Turn*

Item 531.38: W1-2 Curve*

Item 531.39: W1-3 Reverse Turn*

Item 531.40: W1-4 Reverse Curve*

Item 531.41: W1-5 Winding Road*

Item 531.42: W1-6 Large Arrow*

Item 531.43: W1-7 Large Arrow*

Item 531.44: W16-7 Diagonal Arrow sign*

Item 531.45: W1-8 Chevron Alignment*

Item 531.46: W3-3 Signal Ahead*

Item 531.48: W8-1 BUMP*

Item 531.50: W8-2 DIP*

Item 531.51: W9-2 Lane Ends Merge Left*

Item 531.52: W10-1 Railroad Advance Warning*

Item 531.53: W11-2 Ped Crossing*

Item 531.54: W13-1 Advisory Speed*

Item 531.55: W14-1 DEAD END*

Item 531.56: W14-2 NO OUTLET*

Item 531.57: OM-3 Type 3 Object Marker*

Item 531.58: OM-4P End of Road Marker*

Item 531.59: 9 inch [229 mm] Street Name, Block Numbers*

Item 531.60: W14-1P Dead End Street Marker*

Item 531.61: Special Sign*

Item 531.62: W14-2P No Outlet Street Marker*

Item 531.63: S5-1 School Speed Limit When Flashing***

Item 531.64: W16-9p Ahead**

Item 531.65: W16-2 XXX FT**

Item 531.66: W13-1 30MPH Advisory**

Item 531.67: S4-3A School Zone Arrows*

Item 531.68: S5-2A*

* High Intensity

** Diamond Grade (Fluorescent Yellow Green)

*** Diamond Grade (Fluorescent Yellow Green) with High Intensity White Background

NOTE: <u>All</u> overhead mounted signs shall be Diamond Grade